

# FOSSIL WOOD REPLACED BY LAUMONTITE NEAR CAPE PATERSON, VICTORIA

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## Abstract

Lower Jurassic carbonized wood from Gippsland, Victoria, has been largely replaced by the mineral laumontite, a zeolite which occurs as spheres of radiating acicular crystals which have replaced the fossil wood. In all cases, a shell of carbonaceous material remains. The altered wood has been found at only one locality. Two possible origins of the laumontite are indicated.

## Occurrence

In the shore platform of the bay immediately east of Point Gregory on the Inverloch-Cape Paterson coast, and north of the rock stack shown in Fig. 1, numerous pieces of fossil wood replaced to a considerable degree by the zeolite mineral laumontite occur in the Jurassic sediments forming the coastal cliffs. The

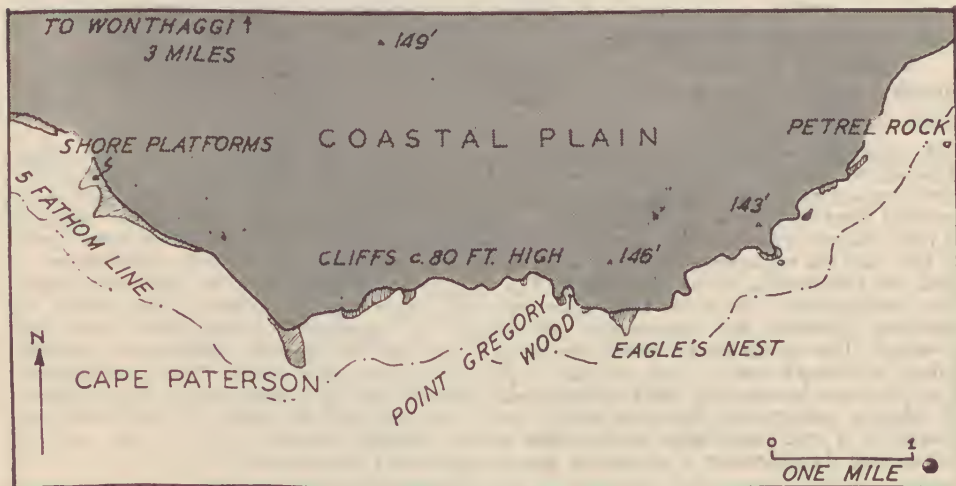


FIG. 1.—Locality plan showing occurrence of Jurassic wood replaced by laumontite.  
Based on military map.

occurrence was discovered by Mr. A. A. Baker, who guided the author to the site. The largest piece of altered wood collected intact is shown in Plate VII. This specimen was collected by Mr. Baker, who kindly presented it to the National Museum of Victoria (Reg. No. P 15681). In addition to the piece figured, there is a smaller piece therefrom about 6 in. long (P 16142). The matrix is arkose of Lower Jurassic age (Medwell 1954).

The laumontite occupies the middle of the pieces of fossil wood (see Plate VII). A large number of pieces was collected, and all had laumontite in the middle with

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carbonaceous material round the outside. In no specimen was the wood totally replaced by the zeolite, nor was the mineral recognized in hand specimen anywhere else at this locality except in the fossil wood. None was seen in joint planes, although a specimen showing such an occurrence at San Remo is in the National Museum collection. At Point Gregory the centres of crystallization seem always to have been established in the fossil wood. Probably it provided more space for crystal growth and/or the mineral had some affinity for the carbonized material.

### Description

At first the zeolite was thought to be stilbite, but X-ray and detailed optical work carried out by Dr. J. McAndrew, Mineragraphic Section, C.S.I.R.O., Melbourne, has shown it to be laumontite. The piece of wood figured in Plate VII is 11 in. long and  $1\frac{1}{2}$  to  $1\frac{3}{4}$  in. in diameter, with a projection at one end which is a branch or root. The laumontite is in crystalline form, appearing on the broken surfaces as a series of rosettes which vary in diameter from  $\frac{1}{2}$  to 2 in. The rosettes in any given piece of wood are mostly of the same size, and are made up of radiating aggregates of whitish crystals showing pearly lustre and good cleavage. Although the radiating crystals have the appearance of rosettes on the broken surfaces, the examination of cross-sections shows that the bunches are actually spherical in shape. The individual crystals are up to an inch long, and 2 mm. wide at their outer extremities. The perimeters of adjacent rosettes are intergrown, carbonized material occupying the interstices.

Samples of the wood were sent to Dr. J. A. Dulhunty of the University of Sydney, with the request that he examine the carbonaceous material. He kindly commented as follows:

"The specimens of wood show a fine outer layer of bright coal from 1 mm. to 2 mm. thick. The rest of the fossil wood, apart from the spheres of radiating laumontite, consists of earthy carbonaceous material. It would appear that before alteration, the fossil wood consisted of an external layer or skin of vitrain enclosing carbonaceous stony material. This is quite common in coal-measure sediments, and it appears to have resulted from the preservation of outer layers of bark and the replacement of inner wood by mineral matter—in other words, coalification of bark and petrification of the inner wood. The elliptical cross sections of the specimens suggest that petrification of the wood took place some time after deposition when a light weight of overlying sediments had accumulated but before any appreciable compressional force had developed. The outside vitrain skin is similar to normal coal but the inner carbonaceous material differs in so much that it is an inorganic replacement of the wood rather than a coalification. The difference between the inner carbonaceous material and the normal coal is a consequence of defective preservation following burial, due to the fact that the pieces of wood were not situated in a true coalification environment which normally develops within a coal seam. It follows that the difference is not simply due to replacement by laumontite."

### Genesis

There appear to be two possible explanations of the origin of the laumontite.

1. *Hydrothermal solutions.* In early Tertiary time there was an extensive vulcanism in the area concerned, and a number of volcanic necks remain (Edwards 1934). It is possible that solutions containing sodium, calcium, alumina and silica invaded the Jurassic sediments in places. From one volcanic neck in the Cape Paterson area laumontite, heulandite and siderite were obtained. However, the occurrence of laumontite described in this paper, and that recorded from San Remo, are not contiguous with any of the known volcanic necks. On the other hand, such necks could exist under the sea, or inland under the screen of younger rocks.

Udluft (1926) has described fossil wood replaced by the zeolites mesolite and apophyllite (in that order) in basaltic tuff on Mt. Elgon in British West Africa.

As with the fossil wood from Victoria, "the outer portions of the wood have never been destroyed but are always preserved, sometimes however to a small depth only" (translation). Udluft visualized the wood being dehydrated by heat and thus making room for the zeolites.

2. *Decomposition of Felspar.* The matrix is arkose, rich in felspar (Edwards and Baker 1943), and the zeolite could have originated from the breakdown of felspar. In this connection, the observation of Edwards and Baker (1943, p. 200) on a cementing material found in the arkose may be significant, viz.

"In many sections the margins of the grains and the chlorite areas are outlined by a narrow rim of a colourless, anisotropic material. This mineral has a refractive index distinctly lower than chlorite, and slightly lower than that of the feldspars. Its birefringence is similar to that of the feldspars, into which it often appears to merge. Occasionally it forms minute spherulitic growths, and in one section it was observed filling the cells of a fragment of wood. The closeness of its refractive index to that of the feldspars suggests that it is authigenic albite, but it may be a zeolitic substance."

There is a considerable possibility, therefore, that the laumontite resulted from the infiltration of the wood by solutions derived from the enclosing arkose during its diagenesis.

### Acknowledgement

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### Bibliography

- EDWARDS, A. B., 1934. Tertiary dykes and volcanic necks of South Gippsland, Victoria. *Proc. Roy. Soc. Vict.*, 47; 112-134.  
———, and BAKER, G., 1943. Jurassic arkose in Southern Victoria. *Ibid.*, 55; 195-228.  
MEDWELL, LORNA M., 1954. A review and revision of the flora of the Victorian Lower Jurassic. *Ibid.*, 65; 63-111.  
UDLUFT, H., 1926. Zeolithe als Fossilisations materiel. *Ark. Kem. Min. Geol.*, 9; 33.